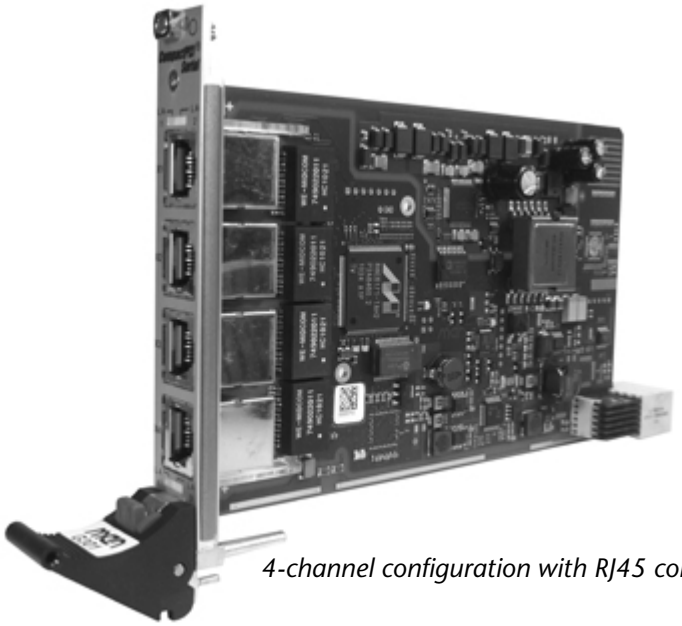
Embedded Solutions

G301 – 3U CompactPCI® Serial Unmanaged 4+1-Port Ethernet Switch



4-channel configuration with RJ45 connectors

User Manual

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G301 – 3U CompactPCI® Serial Unmanaged 4-Port ETH Switch

The G301 is an unmanaged 3U Ethernet switch implemented as a CompactPCI® Serial board. It occupies one peripheral slot, using a 4 HP front panel sporting 4 Gigabit Ethernet ports on RJ45 connectors. Options include M12 front connectors and a P6 connector for the rear I/O Ethernet signals from the board's fifth Gigabit Ethernet port.

The G301 supports full-duplex and half-duplex operation with auto-negotiation, high-speed non-blocking store-and-forward switching, Quality of Service (QoS) support with four traffic classes IEEE 802.1p and three-level 802.1x security. The switch is fault tolerant and restores itself on its own: If a link is temporarily unavailable, frames can be sent via backup/redundant links (spanning tree protocol / link aggregation) and no data loss occurs. Its built-in test mechanisms make the G301 an even more reliable component in the communication system.

In addition, the switch can act as Power over Ethernet (PoE) Power Sourcing Equipment (PSE), supplying other devices on all ports with power.

By using an application-specific configuration EEPROM, the G301 can act similarly to a managed switch with fixed settings. This enables features untypical for unmanaged models like 802.1p priority and port based priority, port based VLAN or IEEE 802.1q VLAN IDs.

The board is specifically designed for rugged mobile communication systems. It is thus for example fully compliant with the EN 50155 railway standard, screened for a -40 to +85×C operation temperature and ready for coating.

Technical Data

Switch Fabric Key Features

- Four 10/100/1000Base-T ports at front panel
  - Electrical isolation: 1,500 Vrms
- Auto-negotiation
- High-speed non-blocking, store-and-forward switching
- 8K MAC address lookup table with automatic learning and aging
- QoS (Quality of Service) support with 4 traffic classes (IEEE 802.1p tagged frames)
- Layer 2 switching
- Back pressure or IEEE802.3x flow control
- Automatic MDI/MDI-X crossover (all ports)

Security Features

- MAC based access list (ACL) for traffic filtering
- Rate-limiting and storm control to prevent packet flooding from malicious peers

Supported Ethernet Standards

- Transparent bridging: IEEE 802.1d, 2004
- VLAN: IEEE 802.1q Rev D5.0, 2005
- Port based VLANs: IEEE 802.1q Rev D5.0, 2005
- Link aggregation: IEEE 802.3ad, 2005
- Power over Ethernet support: IEEE 802.1af
- Priority based switching: IEEE 802.1p

Power Over Ethernet Features

- Power over Ethernet functions on all ports
  - PSE (Power Sourcing Equipment) function
  - Supports supply classes 0 to 3
  - Supplies up to four PD devices (up to 28 W total)

Front I/O

- 4 Ethernet ports on RJ45 or M12 connectors
- 4 link and activity Ethernet status LEDs (2 per channel)

Rear I/O

- 1 Ethernet link via PCIe®

CompactPCI® Serial

- Compliance with CompactPCI® Serial PICMG CPCI-S.0 Specification
- Peripheral slot
- Host interface: one PCI Express® x1 link
  - PCIe® 1.x support
  - Data rate up to 250 MB/s in each direction (2.5 Gbit/s per lane)

Electrical Specifications

- Supply voltage/power consumption
  - +12 V (-3%/+5%), 2.4 W approx. (without PoE), 28 W PoE max.

Mechanical Specifications

- Dimensions: conforming to CompactPCI® Serial specification for 3U boards
- Front panel: 4HP with ejector
- Weight: 162 g (with RJ45 connectors)/188 g (with M12 connectors)

Environmental Specifications

- Temperature range (operation):
  - -40..+85°C (screened)
  - Airflow: 1.0 m/s
- Temperature range (storage): -40..+85°C
- Relative humidity (operation): max. 95% non-condensing
- Relative humidity (storage): max. 95% non-condensing
- Altitude: -300 m to +3,000 m
- Climatic tests according to EN 68068
- Shock and vibration tested according to EN 61373
- Conformal coating on request

MTBF

- 211,019 h @ 40°C according to IEC/TR 62380 (RDF 2000)

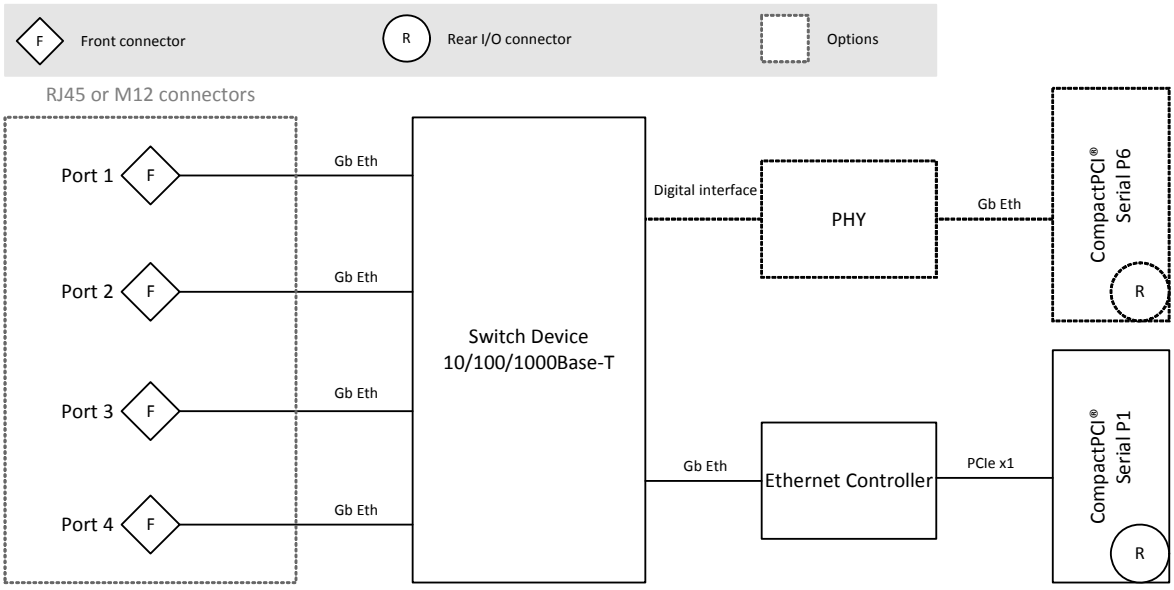
Safety

- PCB manufactured with a flammability rating of 94V-0 by UL recognized manufacturers

EMC

- Tested according to EN 55022 (radio disturbance), IEC1000-4-2 (ESD) and IEC1000-4-4 (burst)

Block Diagram



Configuration Options

Ethernet Switch

- Fixed managed version
  - With fixed configuration according to customer requirements

Front Connectors

- RJ45 connectors or M12 connectors

Rear I/O

- CompactPCI® P6 connector
  - For fifth Gigabit Ethernet 1000Base-T port (10/100 Mbit/s not supported)

Environmental specifications

- Conformal coating

Cooling Concept

- Also available with conduction cooling in MEN CCA frame

Please note that some of these options may only be available for large volumes. Please ask our sales staff for more information.

For available standard configurations see online data sheet.

Product Safety

Electrostatic Discharge (ESD)

Computer boards and components contain electrostatic sensitive devices. Electrostatic discharge (ESD) can damage components. To protect the board and other components against damage from static electricity, you should follow some precautions whenever you work on your computer.

- Power down and unplug your computer system when working on the inside.
- Hold components by the edges and try not to touch the IC chips, leads, or circuitry.
- Use a grounded wrist strap before handling computer components.
- Place components on a grounded antistatic pad or on the bag that came with the component whenever the components are separated from the system.
- Store the board only in its original ESD-protected packaging. Retain the original packaging in case you need to return the board to MEN for repair.

About this Document

This user manual describes the hardware functions of the board, connection of peripheral devices and integration into a system. It also provides additional information for special applications and configurations of the board.

The manual does not include detailed information on individual components (data sheets etc.). A list of literature is given in the appendix.

History

Issue	Comments	Date
E1	First issue	2011-04-26
E2	Minor change to "Ethernet switch" chapter (MII -> GMII digital interface)	2011-05-05
E3	Rear port restricted to 1000Base-T, power consumption value added	2012-02-03
E4	General update (PoE)	2012-10-04

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This sign marks important notes or warnings concerning the use of voltages which can lead to serious damage to your health and also cause damage or destruction of the component.

This sign marks important notes or warnings concerning proper functionality of the product described in this document. You should read them in any case.

italics — Folder, file and function names are printed in *italics*.

bold — **Bold** type is used for emphasis.

`monospace` — A `monospaced` font type is used for hexadecimal numbers, listings, C function descriptions or wherever appropriate. Hexadecimal numbers are preceded by "0x".

comment — Comments embedded into coding examples are shown in green color.

hyperlink — Hyperlinks are printed in blue color.

The globe will show you where hyperlinks lead directly to the Internet, so you can look for the latest information online.

IRQ#
/IRQ — Signal names followed by "#" or preceded by a slash ("/") indicate that this signal is either active low or that it becomes active at a falling edge.

in/out — Signal directions in signal mnemonics tables generally refer to the corresponding board or component, "in" meaning "to the board or component", "out" meaning "coming from it".

Vertical lines on the outer margin signal technical changes to the previous issue of the document.

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Since January 2005 the SMD and manual soldering processes at MEN have already been completely lead-free. Between June 2004 and June 30, 2006 MEN's selected component suppliers have changed delivery to RoHS-compliant parts. During this period any change and status was traceable through the MEN ERP system and the boards gradually became RoHS-compliant.

WEEE Application

The WEEE directive does not apply to fixed industrial plants and tools. The compliance is the responsibility of the company which puts the product on the market, as defined in the directive; components and sub-assemblies are not subject to product compliance.

In other words: Since MEN does not deliver ready-made products to end users, the WEEE directive is not applicable for MEN. Users are nevertheless recommended to properly recycle all electronic boards which have passed their life cycle.

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Contents

1 Getting Started 12
1.1 Front panels 12
1.2 Integrating the Board into a System 12
2 Functional Description 13
2.1 Power Supply 13
2.2 Ethernet Ports 13
2.3 Ethernet Switch 15
2.3.1 Configuration of the Switch 15
2.4 Power over Ethernet 16
2.5 Front Panel Status LEDs 16
3 Appendix 17
3.1 Literature and Web Resources 17
3.2 Finding out the Board's Article Number, Revision and Serial Number 17

Figures

Figure 1. Front Panels: Standard RJ45 model (left) and optional M12 model (right) 12
Figure 2. Labels giving the board's article number, revision and serial number 17

Tables

Table 1. Pin assignment of the Gigabit Ethernet RJ45 connectors. 13
Table 2. Pin assignment of the Gigabit Ethernet M12 connectors 14
Table 3. Default switch configuration at startup 15
Table 4. Power over Ethernet configuration. 16
Table 5. Ethernet port status LEDs. 16

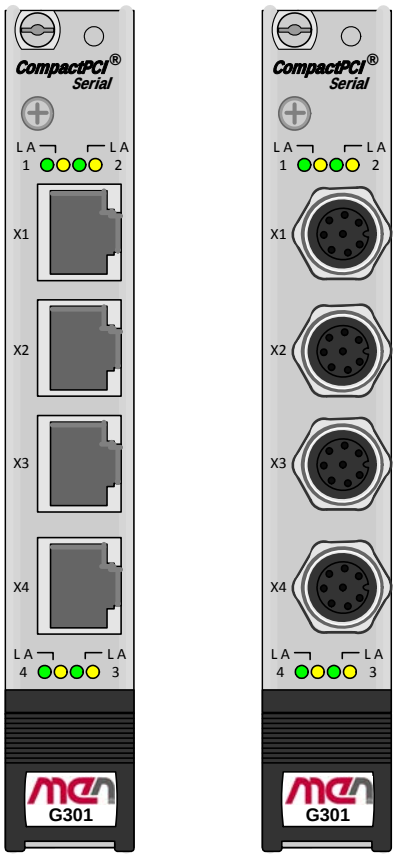
1 Getting Started

1.1 Front panels

Two different types of front panels are available:

- 4 RJ45 connectors on a 4-HP (1-slot) front panel (standard model)
- 4 8-pin female M12 connectors on a 4-HP (1-slot) front panel (option)

Figure 1. *Front Panels: Standard RJ45 model (left) and optional M12 model (right)*



1.2 Integrating the Board into a System

You can use the following check list when installing the board in a system for the first time and with minimum configuration.

☑ Power-down the system.

☑ Insert the G301 into a CompactPCI Serial peripheral slot of your CompactPCI Serial or hybrid system, making sure that the CompactPCI Serial connector is properly aligned.

Note: The peripheral slots of every CompactPCI Serial system are marked by a circle ○ on the backplane and/or at the front panel.

☑ Power-up the system.

2 Functional Description

2.1 Power Supply

The G301 is supplied with +12V (-3%/+5%) via the CompactPCI Serial bus.

2.2 Ethernet Ports

Depending on the configuration, the G301 has four or five Ethernet ports.

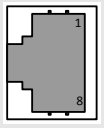
Four Gigabit Ethernet ports are available at the front panel on either RJ45 or 8-pin female M12 connectors. An optional fifth Gigabit Ethernet port can be made available via the P6 connector (not assembled on standard models, pin assignment compliant with the CompactPCI Serial standard for peripheral boards).

Connection via RJ45 Connectors

Connector types:

- Modular 8/8-pin mounting jack according to FCC68
- Mating connector:
  Modular 8/8-pin plug according to FCC68

Table 1. *Pin assignment of the Gigabit Ethernet RJ45 connectors*

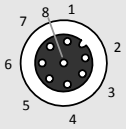
	Pin	Name	Description
	1	D_1+	Gigabit pair 1 +
	2	D_1-	Gigabit pair 1 -
	3	D_2+	Gigabit pair 2 +
	4	D_3+	Gigabit pair 3 +
	5	D_3-	Gigabit pair 3 -
	6	D_2-	Gigabit pair 2 -
	7	D_4+	Gigabit pair 4 +
	8	D_4-	Gigabit pair 4 -

Connection via M12 Connectors

Connector types:

- 8-pin M12 connector, female, A-coded
  (Phoenix Contact 1436974 SACC-DSIV-FS-8CON-L90 SCO)
- Mating connector:
  8-pin M12 connector, e.g., CONEC "SAL-12S-RS8-2/G3" 43-10980

Table 2. *Pin assignment of the Gigabit Ethernet M12 connectors*

	Pin	Name	Description
	1	D_3-	Gigabit pair 3 -
	2	D_4+	Gigabit pair 4 +
	3	D_4-	Gigabit pair 4 -
	4	D_1-	Gigabit pair 1 -
	5	D_2+	Gigabit pair 2 +
	6	D_1+	Gigabit pair 1 +
	7	D_3+	Gigabit pair 3 +
	8	D_2-	Gigabit pair 2 -

2.3 Ethernet Switch

The G301 uses a 5-port 10/100/1000Base-T switch component, the Marvell 88E6171. The switch provides 10/100/1000 Mbits/s configuration possibility on the four front Ethernet ports and 1000 Mbits/s on the rear Ethernet port.

It is also possible to configure each port in half-duplex or full-duplex.

The switch characteristics are:

- Four external front ports configurable as 10/100/1000 Mbits/s and one rear port fixed to 1000 Mbits/s
- GMII digital interface (not supported in standard G301 models)
- Each external port is configurable in half-duplex or full-duplex mode
- Non-blocking wire speed switching
- Store-and-forward mode
- Auto negotiation
- Port mirroring
- Port monitoring
- Flow control
- VLAN support
- Automatic MDI/MDI-X crossover (all ports)
- Port based frame priorization

2.3.1 Configuration of the Switch

The G301 loads the following standard configuration for all ports at startup:

Table 3. *Default switch configuration at startup*

Setting	Default
Duplex mode	Full Duplex
Port speed	Auto-Negotiate
VLAN (port-based)	Off
QoS (Quality of Service)	Off
Port mirroring and port monitoring	Off
Port trunking	Off
Power over Ethernet functionality	PSE functionality enabled

By using a customer-specific configuration EEPROM, the G301 can act similarly to a managed switch with fixed settings. Please contact MEN if you need a switch with a non-standard configuration.

2.4 Power over Ethernet

All front panel ports of the G301 support Power over Ethernet PSE ("power sourcing equipment") functionality according to IEEE802.3af.

The G301 can deliver power to up to four PD ("powered device") devices.

Table 4. *Power over Ethernet configuration*

Class	Power range	Number of possible devices
0	0.44..12.96 W	2
1	0.44..3.84 W	4
2	3.84..6.49 W	4
3	6.49..12.95 W	2

A combination of different classes is also possible. Please note, however, that the combined power level drawn by connected PDs must not exceed 28 W!

2.5 Front Panel Status LEDs

The front panel features two LEDs for each of the four Ethernet ports to display their status (*LNK* and *ACT*). The LEDs act as described in the following table.

Table 5. *Ethernet port status LEDs*

LED	Description
L	Ethernet link status (on = link established)
A	Ethernet traffic activity status (blink = Ethernet traffic running)

3 Appendix

3.1 Literature and Web Resources

- G301 data sheet with up-to-date information and documentation: www.men.de/products/02G301-.html

3.2 Finding out the Board's Article Number, Revision and Serial Number

MEN user documentation may describe several different models and/or hardware revisions of the G301. You can find information on the article number, the board revision and the serial number on two labels attached to the board.

- **Article number:** Gives the board's family and model. This is also MEN's ordering number. To be complete it must have 9 characters.
- **Revision number:** Gives the hardware revision of the board.
- **Serial number:** Unique identification assigned during production.

If you need support, you should communicate these numbers to MEN.

Figure 2. *Labels giving the board's article number, revision and serial number*